

Factors Influencing Production Rates in the Raven River Member of the Cardium Formation in Garrington, Alberta

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Summary

The Cardium Formation in the Garrington Field was historically drilled targeting the lower stratigraphic unit called the Burnstick Member, a linear, sandstone conglomeratic reservoir trending northwest – southeast. The Burnstick Member is well documented and interpreted by many authors including Berven (1966), Krause and Nelson (1984), Pattison and Walker (1992), Plint et al. (1986) and Shank and Plint (2013). Recent technological advances permit more sophisticated techniques, opening more prospects in previous uneconomic areas, such as the Raven River Member of the Cardium Formation in the Garrington Field.

The upper stratigraphic unit named the Raven River Member is bounded by the T4 surface below and E5 surface above. The Raven River Member is less studied than the Burnstick Member and was initially interpreted by Walker (1983) as a regional heterolithic, sandy-sheet deposit, and later revised by Walker and Eyles (1988) as partially overlapping lobes observed near the Willesden Green area. The sand/mud content, trace fossil suites and sedimentary structures observed in core indicate the Raven River Member in the Garrington Field is a lower shoreface, muddy sandstone deposit that is highly heterolithic due to mud laminations and intense bioturbation. Lateral heterogeneity, facies distribution and diagenesis are sedimentological factors affecting production rates by influencing porosity and permeability within the study area. However, areas of thickest net pay do not correspond with the highest cumulative production but 12-mo production rates are highest in the west where net pay is thin. Alternatively, there is a stronger correlation between production rates and reservoir properties.

Pressure gradients from the Raven River Member in the Garrington Field are higher in the west compared to the east with values in the west reaching up to 12 kpa/m, and with values as low as 4 kpa/m in the east. Similarly, 12-mo production rates in the study area range from 20 to 80 bopd of oil from the west to 15 to 53 bopd of oil to the east. There is a positive correlation between higher production rates with areas of higher pressure gradients within the study area. With recent exploitation of muddy sandstone deposits in the Raven River Member by multi-stage fractured horizontal wells, a refined characterization and discussion of the depositional environment of the Raven River Member in the Garrington Field will be presented, focusing on factors affecting reservoir properties in the region and their influences on production.

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References

- Berven, R. J., 1966, Cardium sandstone bodies, Crossfield-Garrington area, Alberta: *Bulletin of Canadian Petroleum Geology*, v. 14, no. 2, p. 208-240.
- Krause, F. F., and Nelson, D. A., 1984, Storm event sedimentation; lithofacies association in the Cardium Formation, Pembina area, west-central Alberta, Canada: *Memoir - Canadian Society of Petroleum Geologists*, v. 9, p. 485-511.
- Pattison, S. A. J., and Walker, R. G., 1992, Deposition and interpretation of long, narrow sandbodies underlain by a basinwide erosion surface; Cardium Formation, Cretaceous Western Interior Seaway, Alberta, Canada: *Journal of Sedimentary Petrology*, v. 62, no. 2, p. 292-309.
- Plint, A. G., Walker, R. G., and Bergman, K. M., 1986, Cardium Formation 6; Stratigraphic framework of the Cardium in subsurface: *Bulletin of Canadian Petroleum Geology*, v. 34, no. 2, p. 213-225.
- Shank, J. A., and Plint, A. G., 2013, Allostratigraphy of the Upper Cretaceous Cardium Formation in subsurface and outcrop in southern Alberta, and correlation to equivalent strata in northwestern Montana: *Bulletin of Canadian Petroleum Geology*, v. 61, no. 1, p. 1-40.
- Walker, R. G., 1983, Cardium Formation 2. Sand-Body Geometry and Stratigraphy in the Garrington-Caroline-Ricinus Area, Alberta - The "Ragged Blanket" Model: *Bulletin of Canadian Petroleum Geology*, v. 30, no. 1, p. 14-26.
- Walker, R. G., and Eyles, C. H., 1988, Geometry and facies of stacked shallow-marine sandier upward sequences dissected by erosion surface, Cardium Formation, Willesden Green, Alberta: *AAPG Bulletin*, v. 72, no. 12, p. 1469-1494.